A BLIND *HOMOLOPHUS BICEPS* (ARACHNIDA: OPILIONES)[1]

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ABSTRACT: Scanning electron microscopy of a harvestman, *Homolophus biceps*, that lacked both eyes and ocular tubercle revealed no indication of external damage or healing. Internally, light microscope sections showed no evidence of eyes. The brain had no or very degenerate optic nerve masses. The ventral nerve cord was also reduced. Of the three possible causative mechanisms *i.e.*, physical damage, genetic change and biochemical disruption, the last is the most plausible.

There are three suborders of the Opiliones, of which two, the Laniatores and Palpatores, typically have two eyes. Members of the third suborder, the Cyphophthalmi, are usually blind. Though the degree of eye development varies between species (Curtis, 1970; Juberthie and Muñoz-Cuevas, 1973), it is a rare event for a species with eyes to produce eye-less individuals. Thus when we found a blind specimen of a normally sighted species, we tried to discover how it became blind. As the specimen was preserved 18 years previous to our study, we were limited to a morphological and anatomical inquiry of the cause and extent of the abnormality.

Materials and Methods

The eye-less specimen, an adult female *Homolophus biceps* (Thorell), was collected by A.L. Turnbull between 14 May and 8 June 1963 near Seven Persons, Alberta (49° 51'N, 110° 54'W, an area of short grass prairie). The specimen was taken along with another female and eight immatures that are apparently normal. After removal from the ethyleneglycol and water mixture of the pit-trap, the specimen was preserved in ethanol. When the abnormality was noted, the specimen was taken through a dehydration series of ethanol to 100%, critical point dried with carbon dioxide, mounted, sputter coated with gold (15 nm thick), and examined with a scanning electron microscope (SEM). Then the specimen was removed from its mount and infiltrated and embedded in plastic (Spurr, 1969). After polymerization, it was sectioned (7 μm) and stained (1% aqueous toluidine blue) for light microscopy.

For SEM comparisons a normal adult female that was collected in

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Osoyoos, British Columbia was treated in the same fashion.

For light microscopy comparisons we used previously prepared slides of normal subadult to adult females that were collected near Cypress Lake, Saskatchewan. These specimens had been fixed in Brasil's fluid, embedded in paraffin, sectioned (6 μm), and stained with Mallory's triple stain.

Nomenclature of the nervous system follows Bullock and Horridge (1965).

Results

When we examined the abnormal specimen with SEM, there was no evidence of either any damage to the integument or of any, even rudimentary, development of an ocular tubercle (Fig. 1). There were a few shallow indentations in the region near where the ocular tubercle should have been, but these were also observed in the normal specimen (Fig. 2) and are almost certainly artifacts of cuticle collapse caused by drying.

Light microscopy of the abnormal specimen revealed that the tissues were, considering their history, remarkably well preserved (Fig. 3). However, there was substantial (microbial?) degradation of the digestive diverticulae, and most structures within the brain and ventral nerve cord were very difficult or impossible to distinguish. There was no evidence of an ocular tubercle, eyes or optic nerves. Optic nerve masses were absent or very much reduced. The ventral nerve cord was also less developed than normal specimens (cf. Fig. 4). The specimen was mature but not gravid.

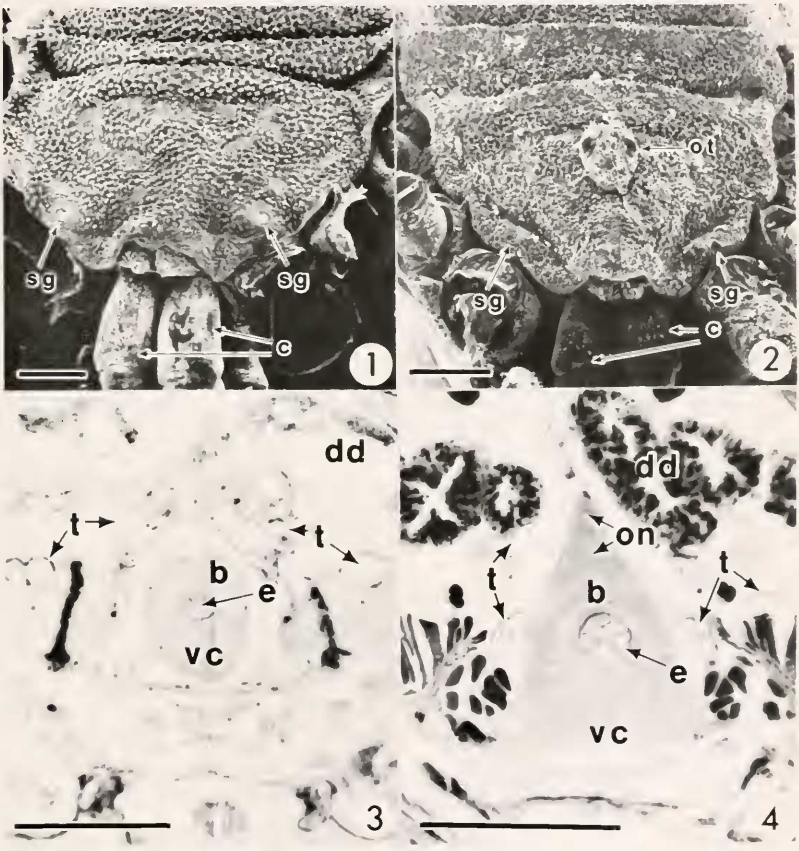
Discussion

From the morphological and anatomical evidence, we conclude that the abnormality was not caused by physical damage. Normally a large wound such as removal of the entire ocular tubercle would cause an opilionid to bleed to death or at least show some irregularities in the cuticle when the wound was repaired during moulting.

A second possible explanation *i.e.*, genetic change, is also unlikely. In cavernicolous species, eye reduction is common and may range from simple eye depigmentation, through absence of eyes, to absence of both eyes and ocular tubercle (Goodnight and Goodnight, 1960). Thus in cavernicolous species at least, degeneration of the eyes seems to be a gradual phenomenon and the result of many gene changes. However if the situation described here involves only a single genetic change, other closely related species occasionally should show the same kind of abnormality (*i.e.*, lack of eyes and ocular tubercle and reduced brain and ventral cord).

The most probable cause of the abnormality was a biochemical

imbalance that occurred during the opilionid's development. Biochemical disruptions may be caused by "exotic" chemicals such as pesticides as well as high temperatures. Juberthie (1968) has shown that in the opilionid *Odiellus gallicus* temperatures between 20 and 23.5°C before or during somite differentiation may cause anopthalmia and indicated that some individuals may survive this disruption.



Figures 1,2. Scanning electron micrographs of an anterior-dorsal view of the cephalothorax of *H. biceps*. Fig. 1. Eye-less specimen. Note the chelicerae (c) and the openings of the scent glands (sg). Fig. 2. Normal specimen with ocular tubercle (ot). Figures 3,4. Light micrographs of cross-sections through brain. Fig. 3. Maximum extent of brain (b) in eye-less specimen. Note esophagus (e), digestive diverticulum (dd), trachaeae (t), and ventral cord (vc). Fig. 4. Maximum extent of brain in a normal subadult female. Note optic nerve masses (on). The position of this section is slightly anterior to Fig. 3. Bars represent 0.5 mm.

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INTERNATIONAL COMMISSION ON ZOOLGOCIAL NOMENCLATURE

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8 December, 1982

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 39, part 4, on 7 December, 1982:

Opinion No.

1227 (p. 233) *Tinea bjerkandrella* Thunberg, 1784 and ***Phalaena (Noctua) cardui*** Hubner, 1790 (Insecta, Lepidopera): conserved.

1231 (p. 243) *Blatta germanica* Linnaeus, 1767 (Insecta, Dictuoptera): conserved and designated as type species of *Blatella* Caudell, 1903.

1238 (p. 262) *Mycteromyia* Philippi, 1865 (Insecta, Diptera): designation of type species.

The Commission regrets that it cannot supply separates of Opinion.

R.V. MELVILLE, Secretary